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BUREAU OF MINES MINERALS YEARBOOK

Cement

UNITED STATES DEPARTMENT OF THE INTERIOR

The statistical data in this volume represents the most comprehensive, verified, domestic and international coverage for 1987 at the time the volume went to press. More recent information can be found in the monthly Cement Mineral Industry Surveys obtainable from Publications Distribution, Bureau of Mines, Box 18070, Cochrans Mill Road, Pittsburgh, PA 1[illegible]5.

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UNITED STATES DEPARTMENT OF THE INTERIOR • Manuel J. Lujan, Jr., Secretary

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This publication is a chapter from the current Bureau of Mines Minerals Yearbook, comprising *Volume I, Metals and Minerals; Volume II, Area Reports: Domestic; Volume III, Area Reports: International.* The separate volumes of the Yearbook are sold by the Superintendent of Documents, Washington, D.C. 20402.

Cement

By Wilton Johnson[1]

U.S. demand for cement increased slightly, reaching a record high for the fifth consecutive year. The value of new construction followed a similar upward trend, driven by small increases in residential and public works activity. All regions of the country experienced gains in cement consumption except the South and West, which remained essentially unchanged.

Domestic production declined for the second year in a row as producers continued to shut down less efficient plants, thereby increasing their dependence on lower cost imports to fill the supply-demand gap. The average reported per-ton value of portland cement sold declined to its lowest level since 1979, while the value of masonry cement sold increased for the sixth consecutive year.

Acquisition of U.S. cement plants continued. By yearend, approximately 55% of U.S. cement production capacity had been acquired by foreign owners, and the sales of other plants were being negotiated.

Domestic Data Coverage.—Domestic production and consumption data for cement are developed by means of the portland and masonry cement voluntary survey. Of the 135 cement manufacturing plants to which an annual survey collection request was made, all responded, representing 100% of the cement production and consumption data shown in table 1.

Table 1.—Salient cement statistics

(Thousand short tons unless otherwise specified)

	1983	1984	1985	1986	1987
United States:[1]					
Production[2]	70,420	77,700	77,895	78,786	78,198
Shipments from mills[2 3]	70,933	80,166	83,032	87,592	89,131
Value[2 3 4] thousands	$3,534,324	$4,152,258	$4,286,399	$4,407,722	$4,393,684
Average value per ton[2 3 4]	$49.95	$51.80	$51.61	$50.32	$49.29
Stocks at mills,[2] Dec. 31	6,711	6,866	7,232	6,725	6,159
Exports	118	80	98	59	52
Imports for consumption	4,221	8,689	14,120	16,128	17,536
Consumption, apparent[5 6]	73,435	84,313	87,456	91,501	93,886
World: Production	r1,010,051	r1,036,392	r1,056,660	p1,100,814	e1,138,673

eEstimated. pPreliminary. rRevised.
[1]Excludes Puerto Rico and the Virgin Islands.
[2]Portland and masonry cement only.
[3]Includes imported cement shipped by domestic producers.
[4]Value received, f.o.b. mill, excluding cost of containers.
[5]Quantity shipped plus imports minus exports.
[6]Adjusted to eliminate duplication of imported clinker and cement shipped by domestic cement manufacturers.

DOMESTIC PRODUCTION

One State agency and 48 companies operated 135 plants in 40 States. In addition, two hydraulic cement manufacturing companies operated two plants in Puerto Rico.

Some of the data are arranged by State or by groups of States that form cement districts. A cement district may represent a group of States or a portion of a State. The States of California, Illinois, New York, Pennsylvania, and Texas are divided to provide more definitive marketing information within those States. Divisions for these States are as follows:

California, Northern.—Points north and west of the northern borders of Kern and San Luis Obispo Counties and the western borders of Inyo and Mono Counties.

California, Southern.—All other counties in California.

Chicago, Metropolitan.—The seven Illinois counties of Cook, Du Page, Kane, Kendall, Lake, McHenry, and Will.

Illinois.—All other counties in Illinois.

New York, Western.—All counties west of a dividing line following the eastern boundaries of Broome, Chenango, Lewis, Madison, Oneida, and St. Lawrence Counties.

New York, Eastern.—All counties east of the above dividing line, except Metropolitan New York.

New York, Metropolitan.—The five counties of New York City (Bronx, Kings, New York, Richmond, and Queens) plus Nassau, Rockland, Suffolk, and Westchester Counties.

Pennsylvania, Eastern.—All counties east of the eastern boundaries of Centre, Clinton, Franklin, Huntingdon, and Potter Counties.

Pennsylvania, Western.—All other counties in Pennsylvania.

Texas, Northern.—All counties north of a dividing line following the northern borders of Burnet, Crockett, Jasper, Jeff Davis, Llano, Madison, Mason, Menard, Milam, Newton, Pecos, Polk, Robertson, San Jacinto, Schleicher, Tyler, Walker, and Williamson Counties.

Texas, Southern.—All counties south of the above dividing line.

PORTLAND CEMENT

Clinker production in the United States, including Puerto Rico, remained essentially unchanged. Clinker imported for grinding into finished cement declined slightly as producers focused more on importation of finished cement to meet customers' needs. Additions to capacity resulting from plant construction in Florida and Texas were more than offset by plant closings in Nebraska, Pennsylvania, Texas, Washington, and Wisconsin.

Production Capacity.—By yearend, multiplant operations were being run by 25 companies. The size of individual companies, as a percentage of total U.S. clinker production capacity, ranged from 0.3% to 9%. The 5 largest producers provided 29% of total clinker production; the 10 largest producers provided a combined 50%. The 10 largest companies, in decreasing order of size of clinker production, were Lone Star Industries Inc., Lehigh Portland Cement Co., Lafarge Corp., Gifford Hill & Co. Inc., Dundee Cement Co., Blue Circle Inc., Southwestern Portland Cement Co., Ideal Basic Industries Inc., Moore McCormack Resources Inc., and CalMat Co.

At yearend, 247 kilns at 121 plants were being operated by 44 companies and 1 State agency in the United States, excluding Puerto Rico. Annual yearend production capacity and capacity utilization remained largely unchanged. The average annual maintenance downtime declined by 18% to 45 days. The average annual capacity of U.S. kilns and plants increased slightly to 350,000 tons and 718,000 tons, respectively, whereas company capacity declined 10% to 1.8 million tons as ownership patterns continued to change. Three plants produced white cement. In addition, 11 plants operated grinding mills using only imported, purchased, or interplant transfers of clinker.

Capacity Added.—Box-Crow Cement Co. began operating its 1-million-ton-per-year, state-of-the-art, dry-process, preheater-precalciner plant at Midlothian, TX. The plant also features a 1,200-ton-per-hour mobile crushing system.

Florida Crushed Stone Co. brought its 600,000-ton-per-year plant on-line in Brooksville, FL. For raw materials, the plant uses waste fines generated from production of limestone aggregate. The plant also features a 125-megawatt power genera-

tion facility and has the capacity to produce 350,000 tons of lime annually.

Plant Closings.—Ash Grove Cement West Inc. closed its Seattle, WA, plant in December and began using it as a distribution terminal. Coplay Cement Co., a subsidiary of the French firm Société des Ciments Français, closed its Nazareth, PA, No. 2 plant and turned it into a distribution facility. Ideal Basic Industries, a subsidiary of Holderbank Financiere Glaris S.A. of Holdererbank, Switzerland, discontinued production at its Superior, NE, plant and used it as a distribution terminal. River Cement Co., owned by RC Cement Co. Inc. of St. Louis, MO, ceased operation at its Orange, TX, plant and began using it as a distribution facility. Southwestern Portland Cement Co., a subsidiary of Southdown Inc. of Houston, TX, closed its Amarillo, TX, plant, and St. Marys Wisconsin Cement Inc. closed its Milwaukee, WI, cement plant and began using it as a distribution terminal.

Corporate Changes.—Ash Grove Cement West, Portland, OR, purchased Kaiser Cement Corp.'s plant at Montana City, MN. The 300,000-ton-per-year plant serves markets in Idaho, Montana, North Dakota, and Oregon, and Washington. Hanson Trust PLC, a large British construction firm, purchased Kaiser Cement Corp. of Oakland, CA. The sale included plants in northern and southern California and San Antonio, TX. National Cement Co., a subsidiary of Société Anonyme des Ciments Vicat of France, purchased the Lebec, CA, plant of General Portland Inc., a subsidiary of Lafarge Corp., also of France. The Pima Maricopa Indian Community bought Phoenix Cement Co. of Clarkdale, AZ, from Gifford-Hill and Co., a subsidiary of C. H. Beazer Holdings PLC of the United Kingdom. In addition to the 600,000-ton-per-year plant, the purchase also included a distribution terminal in Phoenix, AZ, and a nearby limestone deposit.

Presa S.p.A. Cementeria di Robilante, an Italian cement producer, purchased Kaiser Cement Corp.'s San Antonio, TX, plant and continued to operate it as a distribution terminal under the new name of Longhorn Cement Co. Lafarge Corp. relocated its corporate offices from Dallas, TX, to Reston, VA, and exercised its option to acquire National Gypsum Cement Co.'s Alpena, MI, cement plant.

Lone Star Industries Inc. and Centex Cement Corp. formed a joint venture called Mountain Cement Co. to manufacture and market cement in the Rocky Mountain area. Scancem Ans, a Norwegian-based partnership between Norcem Cement A/S of Norway and Industri AB Euroc of Sweden, purchased Allentown Portland Cement Co.'s 830,000-ton-per-year-capacity plant at Evansville, PA.

Table 2.—Portland cement production, capacity, and stocks in the United States, by district[1]

District	1986					1987				
	Plants active during year	Production[2] (thousand short tons)	Capacity[3]		Stocks[4] at mills, Dec. 31 (thousand short tons)	Plants active during year	Production[2] (thousand short tons)	Capacity[3]		Stocks[4] at mills, Dec. 31 (thousand short tons)
			Finish grinding (thousand short tons)	Percent utilized				Finish grinding (thousand short tons)	Percent utilized	
New York and Maine	6	4,018	4,028	99.8	276	5	3,720	4,068	91.4	254
Pennsylvania, eastern	9	4,790	5,903	81.1	344	8	4,759	5,734	82.9	293
Pennsylvania, western	4	1,435	2,310	62.1	175	4	1,538	2,417	63.6	162
Maryland	3	1,771	1,902	93.0	158	3	1,863	2,035	91.5	139
Ohio	6	1,657	2,603	63.6	163	5	1,717	2,460	69.8	164
Michigan	5	4,830	6,740	71.6	468	5	4,925	6,442	76.5	341
Indiana	4	2,347	2,981	78.7	221	4	2,692	2,732	98.5	178
Illinois	4	2,139	2,950	72.5	146	4	1,731	2,548	67.9	308
Georgia and Tennessee	4	2,115	2,565	82.4	226	4	2,194	2,565	85.5	186
South Carolina	3	2,252	3,447	65.3	114	3	2,459	3,447	71.3	101
Kentucky, Virginia, West Virginia	3	2,623	2,812	93.2	177	3	2,480	2,852	86.9	164
Florida	5	3,109	4,186	74.2	227	6	3,383	4,761	71.0	238
Nebraska and Wisconsin	4	W	W	W	W	1	W	W	W	W
Alabama	6	3,494	5,584	62.6	361	6	3,762	5,291	71.1	332
Arkansas, Louisiana, Mississippi	4	1,679	2,790	60.2	153	4	1,508	2,790	54.0	146
Utah	3	1,015	1,365	74.3	102	3	897	1,365	65.7	71
South Dakota	1	632	1,806	35.0	58	1	621	1,800	34.5	65
Iowa	4	2,006	3,072	65.2	292	4	2,172	2,732	79.4	254
Missouri	5	4,636	4,900	94.6	397	5	4,795	4,950	96.8	308
Kansas	5	1,747	2,485	70.2	226	5	1,743	2,435	71.5	203
Oklahoma	3	1,653	2,080	79.4	277	3	1,603	2,099	76.3	240
Texas, northern	9	3,677	5,474	67.1	294	8	3,252	5,665	57.4	213
Texas, southern	9	4,654	6,545	71.1	222	7	4,163	6,448	64.5	160
Idaho and Montana	3	630	975	64.5	124	3	679	960	70.7	107
Colorado and Wyoming	4	1,428	2,720	52.4	134	4	1,286	2,720	47.2	158
Alaska and Oregon	2	W	W	W	W	2	W	W	W	W
Arizona, Nevada, New Mexico	4	2,290	3,015	75.9	141	4	2,013	3,015	66.7	147
California, northern	3	2,727	3,025	90.1	130	3	2,830	3,025	93.5	160
California, southern	8	7,230	9,056	79.8	310	8	7,106	9,196	77.2	316
Hawaii	2	301	520	57.9	42	1	327	350	93.5	31
Washington	4	1,143	2,029	56.3	159	4	1,201	2,029	59.2	153
Total or average	139	75,217	102,288	73.7	6,276	130	74,557	101,351	73.6	5,708
Puerto Rico	2	1,130	2,209	51.1	34	2	1,303	2,176	59.8	34

W Withheld to avoid disclosing company proprietary data; included in "Total."

[1]Includes Puerto Rico. Includes data for three white cement facilities as follows: California (1), Pennsylvania (1), and Texas (1). Includes data for grinding plants (13 in 1986 and 11 in 1987) as follows: Alaska (1), Florida (3) in 1986 and (2) in 1987, Iowa (1) in 1987, Michigan (1), New York (1) in 1986, Pennsylvania (2) in 1986 and (1) in 1987, Texas (3) in 1986 and (1) in 1987, Washington (2) in 1987, and Wisconsin (2).

[2]Includes cement produced from imported clinker (1986—1,727,000 tons and 1987—3,242,000 tons).

[3]Grinding capacity based on fineness necessary to grind Types I and II cement, making allowance for downtime required for maintenance.

[4]Includes imported cement. Source of imports withheld to avoid disclosing company proprietary data.

Table 3.—Clinker capacity and production in the United States,[1] by district, as of December 31, 1987

District	Active plants: Process used: Wet	Active plants: Process used: Dry	Active plants: Process used: Both	Active plants: Total	Number of kilns	Daily capacity (thousand short tons)	Average number of days for maintenance	Apparent annual capacity[2] (thousand short tons)	Production[3] (thousand short tons)	Percent utilized
New York and Maine	4	1		5	6	13.0	64	3,995	3,351	83.8
Pennsylvania, eastern	2	5		7	16	16.0	36	5,091	4,303	84.5
Pennsylvania, western	3	1		4	8	7.0	43	2,088	1,730	82.8
Maryland	1	2		3	7	6.0	53	1,870	1,793	95.8
Ohio	2	2	1	5	8	7.0	47	2,306	1,663	72.1
Michigan	2	2		4	13	17.0	40	5,605	4,016	71.6
Indiana	2	2		4	9	10.0	58	2,997	2,520	84.0
Illinois		4		4	8	8.0	35	2,785	1,616	58.0
Georgia and Tennessee	1	2	1	4	7	7.0	40	2,335	2,174	93.1
South Carolina	2	1		3	7	8.0	60	2,465	2,340	94.9
Kentucky, Virginia, West Virginia	1	2		3	9	8.0	28	2,765	2,356	85.2
Florida	2	2		4	8	10.0	29	3,453	2,587	74.9
Nebraska and Wisconsin		1		1	2	W	99	W	W	W
Alabama	1	5		6	8	[r]4.0	29	4,669	3,023	64.7
Arkansas, Louisiana, Mississippi	4			4	8	8.0	36	2,562	1,386	54.0
Utah	2	1		3	6	4.0	58	1,303	930	71.4
South Dakota			1	1	4	3.0	32	973	569	58.5
Iowa		3		3	6	8.0	45	2,340	1,958	83.6
Missouri	2	3		5	7	14.0	76	4,336	4,310	99.3
Kansas	3	2		5	15	7.0	66	2,076	1,733	83.4
Oklahoma	1	2		3	7	5.0	52	1,713	1,474	86.0
Texas, northern	5	3		8	17	13.0	33	4,365	3,125	71.6
Texas, southern	1	4	1	6	7	16.0	27	5,514	3,670	66.5
Idaho and Montana	3			3	4	2.0	50	742	631	85.0
Colorado and Wyoming	2	2		4	5	5.0	33	1,744	1,177	67.4
Alaska and Oregon		1		1	1	W	36	W	W	97.3
Arizona, Nevada, New Mexico		4		4	11	8.0	46	2,443	1,992	81.5
California, northern		3		3	3	10.0	56	3,023	2,788	92.2
California, southern	1	7		8	24	28.0	35	8,950	7,580	84.6
Hawaii		1		1	1	1.0	42	262	240	91.7
Washington	1	1		2	5	3.0	25	914	572	62.6
Total or average[4]	48	69	4	121	247	272.0	45	[r]86,963	68,719	79.0
Puerto Rico		2		2	9	7.0	53	2,198	1,143	52.0

W Withheld to avoid disclosing company proprietary data; included in "Total."
[r] Revised.
[1] Includes Puerto Rico and white cement producing facilities.
[2] Calculated on individual company data; 365 days, minus average number of days for maintenance, times the reported 24-hour capacity.
[3] Includes production reported for plants that added or shut down kilns during the year.
[4] Data may not add to totals shown because of independent rounding.

Table 4.—Daily clinker capacity in the United States,[1] December 31

Short tons per 24-hour period	Number		Total capacity (short tons)	Percent of total capacity
	Plants	Kilns[2]		
1986:				
Less than 1,150	20	35	16,926	6.5
1,151 to 1,700	32	58	46,585	17.9
1,701 to 2,300	28	52	54,376	20.9
2,301 to 2,800	17	37	42,628	16.3
2,801 and over	27	66	100,205	38.4
Total	124	248	260,720	100.0
1987:				
Less than 1,150	17	27	13,460	4.8
1,151 to 1,700	31	57	45,978	16.5
1,701 to 2,300	21	36	40,622	14.5
2,301 to 2,800	20	40	49,598	17.8
2,801 and over	34	96	129,723	46.4
Total	123	256	279,381	100.0

[1]Includes Puerto Rico and white cement producing facilities.
[2]Total number in operation at plants.

Table 5.—Raw materials used in producing portland cement in the United States[1]

(Thousand short tons)

Raw materials	1985	1986	1987
Calcareous:			
Limestone (includes aragonite, marble, chalk)	77,627	78,995	81,143
Cement rock (includes marl)	24,255	23,495	17,959
Coral	1,277	1,040	935
Other	243	428	--
Argillaceous:			
Clay	5,635	5,734	4,766
Shale	3,182	3,282	4,906
Other (includes staurolite, bauxite, aluminum dross, alumina, volcanic material, other)	123	261	263
Siliceous:			
Sand and calcium silicate	1,930	1,934	1,873
Sandstone, quartzite, other	608	709	758
Ferrous: Iron ore, pyrites, millscale, other iron-bearing material	1,307	1,081	1,079
Other:			
Gypsum and anhydrite	3,959	4,103	4,939
Blast furnace slag	97	74	109
Fly ash	796	689	803
Other, n.e.c	311	346	386
Total[2]	121,350	122,169	119,920

[1]Includes Puerto Rico.
[2]Data may not add to totals shown because of independent rounding.

MASONRY CEMENT

Production of masonry cement remained essentially unchanged. At yearend, 94 plants were manufacturing masonry cement in the United States. Two plants producing masonry exclusively were Chaney Lime & Cement Co., Allgood, AL, and Riverton Corp., Riverton, VA.

Table 6.—Masonry cement production and stocks in the United States, by district

District	1986			1987		
	Plants active during year	Production (thousand short tons)	Stocks[1] at mills, Dec. 31 (thousand short tons)	Plants active during year	Production (thousand short tons)	Stocks[1] at mills, Dec. 31 (thousand short tons)
New York and Maine	4	97	13	4	114	12
Pennsylvania, eastern	7	281	29	6	288	32
Pennsylvania, western	4	93	15	4	86	13
Maryland	2	W	W	2	W	W
Ohio	4	130	18	4	142	22
Michigan	4	271	62	5	259	50
Indiana	4	392	64	4	416	54
Illinois	1	W	W	2	W	W
Georgia and Tennessee	4	214	28	4	230	29
South Carolina	2	W	W	2	W	W
Kentucky, Virginia, West Virginia	4	294	15	4	335	21
Florida	4	415	7	4	435	18
Nebraska and Wisconsin	3	12	7	1	W	W
Alabama	7	249	24	7	278	30
Arkansas, Louisiana, Mississippi	2	69	6	2	W	W
Utah	1	W	W	1	W	W
South Dakota	1	2	1	1	6	3
Iowa	3	47	15	2	W	W
Missouri	4	160	18	4	186	19
Kansas	5	50	20	5	46	15
Oklahoma	3	52	13	3	40	13
Texas, northern	7	164	20	6	89	14
Texas, southern	5	52	8	4	68	8
Idaho and Montana	3	W	W	3	W	W
Colorado and Wyoming	2	W	W	2	W	W
Arizona, Nevada, New Mexico	3	90	6	3	82	7
California, northern	1	W	W	1	W	W
California, southern	1	W	W	1	W	W
Hawaii	1	7	(2)	1	10	1
Washington	3	5	5	2	W	W
Total or average[3]	99	3,569	449	94	3,641	451

W Withheld to avoid disclosing company proprietary data; included in "Total."
[1]Includes imported cement.
[2]Less than 1/2 unit.
[3]Data may not add to totals shown because of independent rounding.

ALUMINOUS CEMENT

Aluminous cement, also known as calcium aluminate cement, high-alumina cement, and Cement Fondu, is a nonportland hydraulic cement. It continued to be produced at the following three plants in the United States: Lehigh, Buffington, IN; Lone Star Lafarge Inc., Chesapeake, VA; and Aluminum Co. of America, Bauxite, AR.

ENERGY

Approximately 76% of the energy consumed in cement production was in the form of fuel for kiln firing to produce clinker. Average energy consumption per ton of clinker produced was 4.1 million British thermal units (Btu).

The average consumption of electrical energy decreased slightly to 135 kilowatthours per ton. Assuming a 40% energy efficiency in conversion of fuel to electrical energy, this represents a fuel equivalent of 1.2 million Btu per ton. Thus, average fuel consumption for kiln firing plus electrical energy, primarily for finish grinding, was approximately 5.4 million Btu per ton, essentially unchanged from that of 1986.

Average fuel consumption for kiln firing in wet-process plants, 4.8 million Btu per ton, was 26% higher than average fuel consumption in dry-process plants, 3.8 million Btu per ton. Approximately 63% of clinker was produced by the dry-process method.

The industry reported 63 suspension and 13 grate preheaters in use during the year. Kilns without preheaters averaged 5.2 mil-

lion Btu per ton of clinker produced; those with suspension preheaters averaged 3.3 million Btu per ton and those with grate-type preheaters averaged 4.9 million Btu per ton.

Coal accounted for 93% of kiln fuel consumption, natural gas accounted for 4%, and oil and waste fuel accounted for the remainder.

Table 7.—Clinker produced in the United States,[1] by fuel

Fuel	Clinker produced			Fuel consumed		
	Plants active during year	Quantity (thousand short tons)	Percent of total	Coal[2] (thousand short tons)	Oil (thousand 42-gallon barrels)	Natural gas (thousand cubic feet)
1986:						
Coal	23	12,644	18.0	2,332		
Coal and oil	30	17,571	26.0	3,086	385	
Coal and natural gas	58	30,887	44.0	4,571		10,641,711
Oil and natural gas						
Coal, oil, natural gas	13	8,501	12.0	1,237	313	1,456,573
Total	124	69,603	100.0	11,226	698	12,098,284
1987:						
Coal	21	9,533	14.0	1,771		
Coal and oil	30	20,212	29.0	3,673	708	
Coal and natural gas	56	29,549	42.0	4,026		10,244,178
Oil and natural gas						
Coal, oil, natural gas	16	10,568	15.0	1,843	347	1,749,183
Total	123	69,862	100.0	11,313	1,055	11,993,361

[1]Includes Puerto Rico.
[2]Includes 1% anthracite, 94% bituminous, and 5% petroleum coke in 1986; 1% anthracite, 95% bituminous, and 4% petroleum coke in 1987.

Table 8.—Clinker produced and fuel consumed by the portland cement industry in the United States,[1] by process

Process	Clinker produced			Fuel consumed		
	Plants active during year	Quantity (thousand short tons)	Percent of total	Coal[2] (thousand short tons)	Oil (thousand 42-gallon barrels)	Natural gas (thousand cubic feet)
1986:						
Wet	52	25,105	36.1	4,833	313	4,074,804
Dry	69	40,951	58.8	5,856	350	7,660,645
Both	3	3,547	5.1	537	35	362,835
Total	124	69,603	100.0	11,226	698	12,098,284
1987:						
Wet	48	23,919	34.2	4,525	545	4,084,751
Dry	71	43,702	62.6	6,459	507	7,783,432
Both	4	2,241	3.2	329	3	125,178
Total	123	69,862	100.0	11,313	1,055	11,993,361

[1]Includes Puerto Rico.
[2]Includes 1% anthracite, 94% bituminous, and 5% petroleum coke in 1986; 1% anthracite, 95% bituminous, and 4% petroleum coke in 1987.

Table 9.—Electric energy used at portland cement plants in the United States,[1] by process

Process	Electric energy used						Finished cement produced (thousand short tons)	Average electric energy used per ton of cement produced (kilowatt hours)
	Generated at portland cement plants		Purchased		Total			
	Active plants	Quantity (million kilowatt hours)	Active plants	Quantity (million kilowatt hours)	Quantity (million kilowatt hours)	Percent		
1986:								
Wet	--	--	53	3,905	3,905	37.4	27,968	139.6
Dry[2]	6	795	73	5,223	6,018	57.7	44,551	135.1
Both	--	--	5	514	514	4.9	3,828	134.3
Total or average	6	795	131	9,642	10,437	100.0	76,347	136.7
Percent of total electric energy used	--	7.1	--	92.4	--	--		
1987:								
Wet	--	--	46	3,028	3,028	29.7	25,851	117.1
Dry[2]	5	582	76	6,248	6,830	66.9	47,652	143.3
Both	--	--	4	344	344	3.4	2,357	145.9
Total or average	5	582	126	9,620	10,202	100.0	75,860	134.5
Percent of total electric energy used	--	5.7	--	94.2	--	--		

[1]Includes Puerto Rico. Includes grinding plants and white cement facilities.
[2]Includes data for grinding plants.

TRANSPORTATION

The pattern of cement transport did not differ significantly from that of recent years. U.S. shipments of portland cement to consumers were primarily in bulk, 94%; by truck, 93%; and made directly from cement manufacturing plants, 67%, rather than distribution terminals.

With respect to shipments of cement from plants to terminals, the preferred modes of transportation were railroads and waterways, 41% each. Transportation by truck accounted for 15%. Cement used at producing plants accounted for the remaining 3%.

Table 10.—Shipments of portland cement from mills in the United States,[1] in bulk and in containers, by type of carrier

(Thousand short tons)

Type of carrier	Shipments from plant to terminal		Shipments to ultimate consumer				Total shipments
			From terminal to consumer		From plant to consumer		
	In bulk	In containers	In bulk	In containers	In bulk	In containers	
1986:							
Railroad	9,309	84	1,254	12	3,639	343	5,242
Truck	2,808	176	24,819	524	49,304	3,614	78,261
Barge and boat	9,121	90	717	--	385	7	1,199
Unspecified[2]	742	--	279	17	392	11	689
Total	21,979	357	27,069	553	53,599	3,975	[3]85,127
1987:							
Railroad	9,050	86	766	202	3,755	297	4,302
Truck	3,231	195	25,506	682	47,381	3,456	77,255
Barge and boat	8,917	12	75	--	229	--	304
Unspecified[2]	539	--	579	68	296	19	1,202
Total[4]	21,738	294	27,257	953	51,661	3,992	[5]83,753

[1]Includes Puerto Rico.
[2]Includes cement used at plant.
[3]Bulk shipments were 94.5%, and container (bag) shipments were 5.5%.
[4]Data may not add to totals shown because of independent rounding.
[5]Bulk shipments were 94.2% and container (bag) shipments were 5.8%.

CONSUMPTION AND USES

Consumer demand for cement in the United States, excluding Puerto Rico, reached a record high 93.9 million tons, the fifth consecutive year of growth following a 20-year low experienced at the depth of the recession in 1982. The amount of construction followed a similar upward pattern. According to the U.S. Department of Commerce, the current dollar value of new construction reached a record $399 billion, slightly higher than that recorded in 1986. Although housing starts declined in all but the north-central region of the country, according to Commerce data the value of residential construction was enhanced because of marked gains in the average house size and increased spending on home improvement.[3]

Shipments of domestically produced cement declined slightly. The gap between production and consumption was filled with imports shipped by producers and independent importers. The level of imports required to meet consumer demands continued to increase, reaching a record high 19% of apparent consumption, with about 70% of imports shipped by domestic producers.

All regions of the country, except the South and the West, registered slight gains in cement consumption. The South, because of its oil-based economy, continued to experience slow economic recovery. A decline of construction activity in the Mountain States resulted in a 9% decrease in cement consumption. However, States in the Pacific region, particularly southern California, continued to enjoy unprecedented growth in cement consumption. The north-central and northeast regions of the country registered the largest increases. The growth in these areas was caused by sharp increases in construction activity during the past few years.

The end-use distribution pattern for portland cement was essentially the same as that of recent years. Ready-mixed concrete producers were the primary consumers, accounting for about 74% of the total, followed by concrete product manufacturers. Smaller amounts were consumed by highway and other contractors; building material dealers; Federal, State, and other government agencies; and a variety of other miscellaneous users.

Table 11.—Portland cement shipped by producers in the United States, by district[1]

District	1986			1987		
	Quantity (thousand short tons)	Value (thousands)	Average per ton	Quantity (thousand short tons)	Value (thousands)	Average per ton
New York and Maine	3,812	$207,905	$54.55	3,511	$180,281	$51.35
Pennsylvania, eastern	4,862	265,800	54.66	4,852	266,953	55.02
Pennsylvania, western	1,428	58,587	40.88	1,473	67,746	45.99
Maryland	1,785	89,799	50.30	1,829	90,020	49.22
Ohio	1,706	79,383	46.53	1,748	83,661	47.86
Michigan	4,713	216,120	45.86	4,755	207,332	43.60
Indiana	2,146	92,327	43.22	2,320	103,177	44.47
Illinois	2,118	83,783	39.55	2,119	86,210	40.68
Georgia and Tennessee	2,254	108,194	48.00	2,262	108,729	48.07
South Carolina	2,306	109,529	47.49	2,567	117,878	45.92
Kentucky, Virginia, West Virginia	2,427	117,986	48.61	2,357	109,101	46.29
Florida	3,189	147,643	46.29	3,565	165,944	46.55
Nebraska and Wisconsin	W	W	W	W	W	W
Alabama	2,477	153,629	44.18	3,600	160,878	44.69
Arkansas, Louisiana, Mississippi	1,668	83,130	49.83	1,759	74,667	42.45
Utah	1,614	58,431	57.62	935	50,565	54.08
South Dakota	635	W	W	W	W	W
Iowa	1,819	86,984	47.81	2,139	104,457	48.83
Missouri	4,642	179,184	38.60	5,110	185,317	36.27
Kansas	1,763	91,110	51.67	1,697	81,045	47.76
Oklahoma	1,579	69,075	43.74	1,415	54,870	38.78
Texas, northern	3,707	198,397	53.51	3,206	158,944	49.58
Texas, southern	5,176	214,300	41.40	4,112	161,052	39.17
Idaho and Montana	707	35,599	50.35	607	34,121	56.21
Colorado and Wyoming	1,458	90,391	61.99	1,265	70,194	55.49
Alaska and Oregon	W	W	W	W	W	W
Arizona, Nevada, New Mexico	2,289	149,312	65.23	2,136	132,623	62.09
California, northern	2,406	142,018	59.02	2,838	167,658	59.08
California, southern	7,083	436,484	61.62	7,099	426,201	60.04
Hawaii	297	24,259	84.59	324	26,550	81.94
Washington	1,212	59,091	48.75	1,282	63,600	49.61
Total[2 3] or average	75,181	3,759,942	50.01	74,868	3,646,561	48.71
Foreign imports[4]	8,814	411,614	46.70	10,480	480,212	45.82
Puerto Rico	1,132	93,288	82.40	1,296	106,185	81.93
Grand total[3] or average	85,127	4,264,844	50.10	[5]86,644	[5]4,232,959	48.85

W Withheld to avoid disclosing company proprietary data; included in "Total."

[1]Includes Puerto Rico. Includes data for three white cement facilities as follows: California (1), Pennsylvania (1), and Texas (1). Includes data for grinding plants (13 in 1986 and 11 in 1987) as follows: Alaska (1), Florida (3) in 1986 and (2) in 1987, Iowa (1) in 1987, Michigan (1), New York (1) in 1986, Pennsylvania (2) in 1986 and (1) in 1987, Texas (3) in 1986 and (1) in 1987, Washington (2) in 1987, and Wisconsin (2).

[2]Includes cement produced from imported clinker.

[3]Data may not add to totals shown because of independent rounding.

[4]Cement imported and distributed by domestic producers only.

[5]Does not include cement consumed at plant.

Table 12.—Masonry cement shipped by producers in the United States,[1] by district

District	1986			1987		
	Quantity (thousand short tons)	Value (thousands)	Average per ton	Quantity (thousand short tons)	Value (thousands)	Average per ton
New York and Maine	102	$6,996	$68.59	131	$8,155	$62.25
Pennsylvania, eastern	297	19,337	65.10	306	22,973	75.07
Pennsylvania, western	94	7,345	78.13	92	7,491	81.42
Maryland	W	W	W	W	W	W
Ohio	138	11,540	83.62	139	11,964	86.07
Michigan	257	17,026	66.24	263	23,004	87.45
Indiana	395	22,936	58.06	422	32,299	76.53
Illinois	W	W	W	W	W	W
Georgia and Tennessee	209	15,031	71.91	230	16,809	73.08
South Carolina	W	W	W	W	W	W
Kentucky, Virginia, West Virginia	292	17,126	58.65	328	21,886	66.73
Florida	352	21,269	60.42	390	24,069	61.72
Nebraska and Wisconsin	W	W	W	W	W	W
Alabama	267	18,165	68.03	291	17,626	60.55
Arkansas, Louisiana, Mississippi	70	4,599	65.70	80	4,651	58.14
Utah	W	W	W	W	W	W
South Dakota	4	W	W	4	W	W
Iowa	48	3,199	66.64	W	W	W
Missouri	167	7,816	46.80	167	10,027	60.04
Kansas	51	3,264	64.00	52	3,150	60.58
Oklahoma	50	3,198	63.96	41	2,436	59.41
Texas, northern	146	11,155	76.40	103	7,589	73.68
Texas, southern	64	4,636	72.43	69	3,694	53.54
Idaho and Montana	3	187	62.33	W	W	W
Colorado and Wyoming	W	W	W	W	W	W
Alaska and Oregon	W	W	W	W	W	W
Arizona, Nevada, New Mexico	89	6,739	75.71	82	6,365	77.62
California, northern	W	W	W	W	W	W
California, southern	W	W	W	W	W	W
Hawaii	7	1,078	154.00	10	1,559	155.90
Washington	6	530	88.33	W	W	W
Total[2] or average	3,525	231,551	65.69	3,680	259,926	70.63
Foreign imports[3]	72	4,616	64.11	103	6,985	67.82
Grand total[2] or average	3,596	236,167	65.68	3,783	266,911	70.55

W Withheld to avoid disclosing company proprietary data; included in "Total."
[1]Does not include quantities produced on the job by masons.
[2]Data may not add to totals shown because of independent rounding.
[3]Cement imported and distributed by domestic producers only. Source of imports withheld to avoid disclosing company proprietary data.

Table 13.—Cement shipments, by destination and origin[1]

(Thousand short tons)

Destination and origin	Portland cement[2]			Masonry cement		
	1985	1986	1987	1985	1986	1987
Destination:						
Alabama	1,306	1,302	1,405	100	112	137
Alaska[3]	156	121	94	W	W	—
Arizona	2,318	2,400	2,299	W	W	W
Arkansas	773	803	766	45	48	42
California, northern	3,439	3,438	3,598	W	W	W
California, southern	6,691	7,844	8,121	W	W	W
Colorado	1,574	1,450	1,110	23	22	16
Connecticut[3]	870	1,037	1,029	17	21	24
Delaware[3]	194	224	254	10	12	15
District of Columbia[3]	116	142	146	1	1	1
Florida	6,140	6,360	6,819	468	499	531
Georgia	2,875	3,224	3,321	228	242	248
Hawaii	214	287	329	7	7	10
Idaho	236	291	251	1	1	(4)
Illinois	1,391	1,511	1,498	28	30	30
Chicago, metropolitan[3]	1,333	1,803	2,037	45	59	66
Indiana	1,353	1,580	1,704	76	97	103
Iowa	1,078	1,046	1,199	11	13	12
Kansas	1,293	1,218	1,351	20	21	25

See footnotes at end of table.

Table 13.—Cement shipments, by destination and origin[1] —Continued

(Thousand short tons)

Destination and origin	Portland cement[2]			Masonry cement		
	1985	1986	1987	1985	1986	1987
Destination —Continued						
Kentucky	1,014	1,115	1,201	78	85	92
Louisiana	2,420	1,964	1,761	65	48	43
Maine	283	336	361	10	12	12
Maryland	1,503	1,666	1,645	139	144	156
Massachusetts[3]	1,395	1,686	1,589	45	53	51
Michigan	2,103	2,478	2,740	104	127	146
Minnesota[3]	1,419	1,464	1,582	40	47	51
Mississippi	758	827	787	57	55	53
Missouri	1,735	2,221	2,091	39	47	53
Montana	190	241	175	1	1	1
Nebraska	783	764	720	11	11	10
Nevada	637	670	754	(4)	(4)	(4)
New Hampshire[3]	374	387	345	15	16	15
New Jersey[3]	1,743	1,972	1,932	78	87	88
New Mexico	620	572	517	10	9	8
New York, eastern	621	670	746	36	42	46
New York, western	812	986	989	43	53	57
New York, metropolitan[3]	1,722	1,932	1,851	50	54	55
North Carolina[3]	1,796	1,980	2,145	238	264	283
North Dakota[3]	286	277	278	5	4	4
Ohio	2,646	3,028	3,314	135	174	189
Oklahoma	1,329	1,107	1,076	40	34	34
Oregon	709	626	728	(4)	(4)	(4)
Pennsylvania, eastern	1,774	1,994	2,132	63	74	87
Pennsylvania, western	1,118	1,222	1,350	70	77	82
Rhode Island[3]	165	199	244	4	6	6
South Carolina	1,019	1,052	1,138	119	136	152
South Dakota	292	332	272	4	4	5
Tennessee	1,480	1,655	1,863	154	184	203
Texas, northern	5,474	4,705	3,799	171	140	96
Texas, southern	5,433	4,531	4,267	101	74	69
Utah	1,059	940	804	2	2	1
Vermont[3]	212	172	173	4	5	6
Virginia	2,116	2,410	2,557	177	219	225
Washington	1,208	1,251	1,361	6	7	8
West Virginia	387	426	455	29	28	31
Wisconsin	1,240	1,475	1,587	39	47	46
Wyoming	413	342	317	2	1	1
U.S. total[5]	83,638	87,756	88,977	3,264	3,556	3,727
Foreign countries[6]	177	145	185	108	105	114
Puerto Rico	962	1,132	1,296	--	--	--
Total shipments[5]	84,778	89,033	90,458	3,373	3,659	3,841
Origin:						
United States[7]	74,250	75,181	74,868	3,187	3,525	3,715
Puerto Rico	962	1,132	1,296	--	--	--
Foreign:[8]						
Domestic producers	5,532	8,814	10,480	62	72	60
Others	4,034	3,909	3,814	124	62	67
Total shipments[5]	84,778	89,033	90,458	3,373	3,659	3,841

W Withheld to avoid disclosing company proprietary data; included with "Foreign countries."

[1]Includes cement produced from imported clinker and imported cement shipped by domestic producers, Canadian cement manufacturers, and other importers. Includes Puerto Rico.

[2]Excludes cement (1986—327,000 tons and 1987—305,000 tons) used in the manufacture of prepared masonry cement.

[3]Has no cement-producing plants.

[4]Less than 1/2 unit.

[5]Data may not add to totals shown because of independent rounding.

[6]Direct shipments by producers to foreign countries and U.S. possessions and territories, includes States indicated by symbol W.

[7]Includes cement produced from imported clinker by domestic producers.

[8]Imported cement distributed by domestic producers, Canadian cement manufacturers, and other importers. Origin of imports withheld to avoid disclosing company proprietary data.

Table 14.—Cement shipments,[1] by region and subregion

Region and subregion[2]	Portland cement				Masonry cement			
	Thousand short tons		Percent of grand total		Thousand short tons		Percent of grand total	
	1986	1987	1986	1987	1986	1987	1986	1987
Northeast:								
New England	3,817	3,742	4.3	4.2	112	114	3.2	3.1
Middle Atlantic	8,774	9,001	10.0	10.1	387	416	10.8	11.2
Total[3]	12,591	12,742	14.3	14.3	499	530	14.0	14.3
South:								
Atlantic	17,508	18,480	20.0	20.8	1,546	1,641	43.5	44.0
East Central	4,900	5,255	5.6	5.9	435	485	12.2	13.0
West Central	13,110	11,674	14.9	13.1	344	285	9.7	7.6
Total[3]	35,518	35,409	40.5	39.8	2,325	2,412	65.4	64.6
North Central:								
East	11,851	12,881	13.5	14.5	528	580	14.9	15.6
West	7,321	7,494	8.3	8.4	147	160	4.1	4.3
Total[3]	19,172	20,374	21.8	22.9	675	740	19.0	19.9
West:								
Mountain	6,906	6,228	7.9	7.0	36	28	1.0	.7
Pacific	13,567	14,231	15.5	16.0	21	18	.6	.5
Total[4]	20,473	20,459	23.4	23.0	57	46	1.6	1.2
Grand total[3]	87,756	88,985	100.0	100.0	3,556	3,727	100.0	100.0

[1]Includes imported cement shipped by domestic and Canadian cement manufacturers and other importers.
[2]Geographic regions as designated by the U.S. Department of Commerce, Bureau of the Census.
[3]Data may not add to totals shown because of independent rounding.
[4]Does not include proprietary data from table 13.

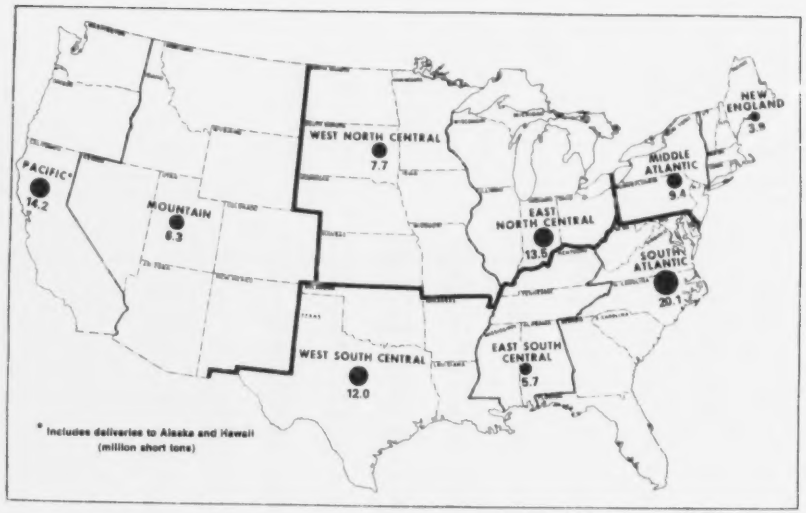

Figure 1.—Shipments of cement by geographic region of destination in 1987.

Table 15.—Portland cement shipments in 1987, by district of origin and type of customer[1]

District of origin	Building material dealers		Concrete product manufacturers		Ready-mixed concrete		Highway contractors		Other contractors		Federal, State, and other government agencies		Miscellaneous including own use		Total[2] (thousand short tons)
	Quantity (thousand short tons)	Percent	Quantity (thousand short tons)	Percent	Quantity (thousand short tons)	Percent	Quantity (thousand short tons)	Percent	Quantity (thousand short tons)	Percent	Quantity (thousand short tons)	Percent	Quantity (thousand short tons)	Percent	
New York and Maine	157	4.5	601	17.1	2,496	71.0	104	2.9	149	4.2	1	--	10	.3	3,517
Pennsylvania, eastern	453	9.3	1,126	23.2	2,983	61.5	103	2.1	34	.7	81	1.7	70	1.5	4,852
Pennsylvania, western	174	11.8	246	16.7	873	59.2	119	8.1	61	4.1	--	--	(3)	.1	1,473
Maryland	98	5.4	365	19.9	1,251	68.4	27	1.5	36	1.9	--	--	53	2.9	1,831
Ohio	141	8.1	295	16.9	1,247	71.3	62	3.6	1	--	(3)	--	3	.1	1,750
Michigan	165	3.4	578	11.8	3,704	75.7	351	7.2	76	1.5	6	.1	15	.3	4,895
Indiana	115	5.0	282	12.2	1,686	72.7	224	9.6	1	--	--	--	12	.5	2,320
Illinois	16	.7	126	6.0	1,749	82.6	191	9.0	37	1.7	--	--	(3)	--	2,119
Georgia and Tennessee	132	5.8	407	18.0	1,516	67.0	68	3.0	101	4.5	30	1.3	9	.4	2,263
South Carolina	57	2.2	429	16.7	1,845	71.8	108	4.2	66	2.6	3	.1	61	2.4	2,568
Kentucky, Virginia, West Virginia	131	5.6	278	11.8	1,683	71.4	169	7.2	74	3.1	--	--	22	.9	2,357
Florida	411	11.5	478	13.4	2,504	70.0	30	.8	70	1.9	9	.3	76	2.1	3,578
Nebraska and Wisconsin	W	W	W	W	W	W	W	W	W	W	--	--	--	--	W
Alabama	251	7.0	532	14.8	2,359	65.4	235	6.5	129	3.6	15	.4	84	2.3	3,604
Arkansas, Louisiana, Mississippi	80	4.6	154	8.8	1,179	67.0	151	8.6	154	8.7	9	.5	32	1.8	1,759
Utah	24	2.6	49	5.3	632	67.6	133	14.3	90	9.6	5	.6	(3)	--	935
South Dakota	5	1.1	26	4.9	310	59.6	75	14.5	45	8.6	W	W	W	W	W
Iowa	73	3.4	371	17.3	1,451	67.8	82	3.8	142	6.7	--	--	21	1.0	2,140
Missouri	203	4.0	346	6.8	3,794	74.2	533	10.4	227	4.4	2	.1	4	.1	5,110
Kansas	71	4.2	82	4.8	1,306	76.9	122	7.2	72	4.3	--	--	44	2.6	1,697

Oklahoma	35	2.5	79	5.6	936	66.1	139	9.8	110	7.7	4	.2	114	8.1	1,417
Texas, northern	144	4.5	333	10.4	1,850	57.7	169	5.3	379	11.8	85	2.6	246	7.7	3,207
Texas, southern	90	2.2	449	10.7	3,032	73.7	187	4.5	271	6.6	39	1.0	53	1.3	4,112
Idaho and Montana	20	3.4	41	6.8	380	62.6	67	11.1	69	11.3	(3)		29	4.8	607
Colorado and Wyoming	39	3.1	120	9.5	921	72.6	166	13.1	15	1.2	1	1	5	.4	1,267
Alaska and Oregon	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Arizona, Nevada, New Mexico	80	3.8	411	19.2	1,301	60.9	59	2.7	277	13.0	(3)		8	.4	2,136
California, northern	260	9.2	363	12.8	2,058	72.5	9	.3	126	4.4	(3)		22	.8	2,838
California, southern	230	3.2	824	11.6	5,481	77.2	24	.3	372	5.2	35	.5	132	2.0	7,099
Hawaii	22	6.9	39	12.1	236	73.0	6	1.9	12	3.7	3	1.1	4	1.3	323
Washington	44	3.4	115	9.0	993	77.3	23	1.8	56	4.3	(3)		54	4.2	1,285
Foreign imports[4]	107	1.0	166	1.6	10,193	97.3							16	.1	10,480
Total[3] or average	3,863	4.5	9,820	11.5	62,938	73.7	3,902	4.6	3,268	3.8	332	.4	1,263	1.5	85,384
Puerto Rico	574	44.3	61	4.7	627	48.4			32	2.5	1	1	(3)		1,296

W Withheld to avoid disclosing company proprietary data; included in "Total."
[1]Includes Puerto Rico.
[2]Data may not add to totals shown because of independent rounding.
[3]Less than 1/2 unit.
[4]Cement imported and distributed by domestic producers only. Source of imports withheld to avoid disclosing company proprietary data.

Table 16.—Portland cement shipped from plants in the United States,[1] by type

Type	1986			1987		
	Quantity (thousand short tons)	Value[2] (thousands)	Average per ton	Quantity (thousand short tons)	Value[2] (thousands)	Average per ton
General use and moderate heat (Types I and II)	78,440	$3,862,869	$49.25	79,499	$3,808,456	$47.91
High-early-strength (Type III)	3,031	159,592	52.65	3,318	175,160	52.80
Sulfate-resisting (Type V)	433	26,295	60.72	716	39,389	55.01
Oil well	1,021	54,667	53.54	899	45,054	50.12
White	317	55,111	173.85	345	59,873	173.54
Portland slag and portland pozzolan	757	39,903	52.71	773	39,827	51.51
Expansive	42	3,743	89.11	50	4,641	92.82
Miscellaneous[3]	1,085	62,663	57.75	1,045	60,558	57.95
Total[4] or average	85,127	4,264,844	50.10	[5]86,644	[5]4,232,959	48.85

[1]Includes Puerto Rico.
[2]Mill value is the actual value of sales to customers, f.o.b. plant, less all discounts and allowances, less all freight charges to customer, less all freight charges from producing plant to distribution terminal if any, less total cost of operating terminal if any, less cost of paper bags and pallets.
[3]Includes waterproof, low-heat (Type IV), and regulated fast-setting cement.
[4]Data may not add to totals shown because of independent rounding.
[5]Does not includes cement consumed at plant.

PRICES

The average mill value of portland cement declined slightly for the third consecutive year reaching its lowest point since 1979, despite record-high shipments to meet consumer demand. The decline can be attributed in part to consumption of record-high levels of imports, which show a corresponding decrease in value, and to extreme competition among producers for a greater share of the domestic market. The average mill value of masonry cement, which was not influenced to any great extent by imports, increased for the sixth consecutive year.

The average price of cement, as reported by Engineering News-Record (ENR), declined slightly to about $63.70 per ton. The ENR prices were based on an average per ton value of cement delivered to 20 cities. The prices range from a low of $46 per ton in Dallas, TX, to a high of $79 in New York City.[3]

Table 17.—Average mill value, in bulk, of cement in the United States[1]

(Per short ton)

Year	Portland cement	Prepared masonry cement[2]	All classes of cement
1983	$49.89	$63.74	$50.45
1984	51.62	67.02	52.24
1985	51.30	66.64	51.87
1986	50.10	65.68	50.73
1987	48.85	70.55	49.76

[1]Includes Puerto Rico. Mill value is the actual value of sales to customers, f.o.b. plant, less all discounts and allowances, less all freight charges from producing plant to distribution terminal if any, less total cost of operating terminal if any, less cost of paper bags and pallets.
[2]Masonry cement made at cement plants only.

FOREIGN TRADE

According to trade data reported by the U.S. Department of Commerce, Bureau of the Census, the United States and its and territories experienced the third consecutive year of record-high imports. Combined imports of hydraulic cement and clinker increased 9% to 17.7 million tons, accounting for approximately 19% of apparent consumption. In decreasing order, Mexico, Canada, and Spain were the principal import sources, providing for more than 69% of the total. The increases were due primarily to gray cement imports. Clinker imports declined slightly, while white cement experienced a moderate increase.

In other foreign trade developments, Allied Cement Co. opened a 600,000-ton-annual-throughput-capacity terminal in the Port of Los Angeles, CA. Allied imports cement from Japan and Taiwan. CalMat Co. was expected to purchase 50% interest in the operation.

Coastal Cement Corp. opened a 400,000-ton-capacity import terminal in Boston, MA, to import cement from Spain.

Exports of hydraulic cement and clinker as reported by the Bureau of the Census declined slightly to 53,000 tons. Cement was shipped to more than 40 countries with Canada receiving 87% of the total.

Table 18.—U.S. exports of hydraulic cement and cement clinker, by country

Country	1985		1986		1987	
	Quantity (short tons)	Value (thousands)	Quantity (short tons)	Value (thousands)	Quantity (short tons)	Value (thousands)
Bahamas	479	$46	1,780	$152	706	$58
Canada	88,626	18,735	54,390	7,668	45,301	7,025
Mexico	3,903	1,477	1,121	445	3,307	1,255
Venezuela	114	128	56	20	651	331
Other[1]	r4,775	r1,092	r1,209	r719	2,964	794
Total[2]	97,897	21,478	58,556	9,024	52,009	9,563

rRevised.
[1]Includes 50 countries in 1985, 42 in 1986, and 39 in 1987.
[2]Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census, U.S. Department of Commerce.

Table 19.—U.S. imports for consumption of hydraulic cement and clinker, by country

(Thousand short tons and thousand dollars)

Country	1985			1986			1987		
	Quantity	Value		Quantity	Value		Quantity	Value	
		Customs	C.i.f.[1]		Customs	C.i.f.[1]		Customs	C.i.f.[1]
Canada	3,393	131,117	145,005	3,272	123,220	133,907	4,154	146,633	157,606
Colombia	662	16,430	20,244	913	22,566	28,079	612	14,914	22,090
France	552	13,866	18,319	669	18,355	24,016	772	15,152	24,373
Greece	511	9,760	12,202	1,275	26,710	33,507	1,641	36,559	49,141
Japan	1,134	28,786	37,105	750	20,325	24,853	723	18,351	25,108
Korea, Republic of	484	26,194	29,738	456	11,814	15,202	616	14,241	18,095
Mexico	2,502	75,755	87,339	4,242	110,390	133,403	4,960	125,666	156,585
Spain	3,383	80,448	103,353	3,176	90,479	110,230	3,044	80,745	106,996
Venezuela	1,569	38,282	50,320	1,290	31,739	41,673	766	17,534	24,498
Other	298	16,791	20,148	276	13,395	17,586	438	18,677	22,096
Total[2]	14,487	437,429	523,773	16,319	468,993	562,427	17,726	488,532	606,588

[1]Cost, insurance, and freight.
[2]Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census, U.S. Department of Commerce.

Table 20.—U.S. imports for consumption of clinker, by country

(Thousand short tons and thousand dollars)

Country	1985			1986			1987		
	Quantity	Value		Quantity	Value		Quantity	Value	
		Customs	C.i.f.[1]		Customs	C.i.f.[1]		Customs	C.i.f.[1]
Canada	746	22,156	25,763	358	10,534	12,768	846	25,056	28,150
Colombia	193	3,938	5,012	280	5,814	7,031	58	1,265	1,515
France	414	9,434	11,789	529	11,328	14,324	342	7,839	9,818
Greece	407	7,900	9,390	507	9,598	13,159	343	6,330	8,272
Japan	291	6,397	7,840	234	4,897	4,839	37	883	1,222
Mexico	581	14,671	16,387	1,095	19,199	23,823	1,215	21,114	26,241
Spain	1,656	31,877	39,917	711	13,726	17,653	734	14,121	17,543
Other	r345	r6,694	r8,315	r258	r4,603	r6,970	93	2,765	2,941
Total[2]	4,633	103,067	124,413	3,972	79,699	100,567	3,668	79,373	95,702

rRevised.
[1]Cost, insurance, and freight.
[2]Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census, U.S. Department of Commerce.

Table 21.—U.S. imports for consumption of hydraulic cement and clinker, by customs district and country

(Thousand short tons and thousand dollars)

Customs district and country	1986			1987		
	Quantity	Value		Quantity	Value	
		Customs	C.i.f.[1]		Customs	C.i.f.[1]
Anchorage:						
Canada	16	1,566	1,978	8	431	766
Japan	29	1,079	1,176	30	1,263	1,514
Korea, Republic of	(2)	7	8	10	322	516
Total	45	2,652	3,162	48	2,016	2,796
Baltimore:						
Bahamas	--	--	--	13	327	414
Belgium	(2)	64	79	--	--	--
Brazil	(2)	1	2	--	--	--
Colombia	13	368	451	19	492	693
Germany, Federal Republic of	(2)	13	15	(2)	8	9
Greece	50	1,133	1,256	189	4,431	4,808
Japan	(2)	50	69	--	--	--
Mexico	14	313	495	13	373	501
Netherlands	67	1,760	1,879	(2)	28	29
Spain	(2)	35	40	--	--	--
Venezuela	62	1,709	2,196	84	2,144	2,587
Yugoslavia	(2)	52	98	--	--	--
Total[3]	208	5,498	6,580	318	7,803	9,041
Boston:						
Canada	138	4,878	5,165	147	4,048	4,224
Greece	92	2,277	2,358	123	2,885	3,090
Mexico	28	768	799	7	158	173
Spain	10	213	223	26	1,891	1,988
Venezuela	23	540	655	--	--	--
Total[3]	292	8,676	9,201	303	8,982	9,474
Buffalo:						
Canada	950	30,809	36,431	964	37,582	37,868
Japan	--	--	--	(2)	12	12
Total	950	30,809	36,431	964	37,594	37,880
Charleston:						
Canada	--	--	--	(2)	5	5
Germany, Federal Republic of	--	--	--	(2)	6	8
Greece	60	1,204	1,500	--	--	--
Netherlands	(2)	17	21	--	--	--
Panama	--	--	--	31	681	853
Spain	--	--	--	30	780	980
Total[3]	60	1,221	1,521	61	1,472	1,845
Chicago:						
Germany, Federal Republic of	(2)	118	152	(2)	225	252
Japan	--	--	--	(2)	7	10
Total	(2)	118	152	(2)	232	262
Cleveland:						
Canada	37	1,450	1,721	176	5,781	7,558
Netherlands	1	398	781	--	--	--
Spain	--	--	--	(2)	2	2
United Kingdom	1	27	27	(2)	24	24
Total[3]	39	1,875	2,529	176	5,807	7,585
Detroit:						
Belgium-Luxembourg	(2)	28	28	--	--	--
Canada	349	17,728	18,365	938	33,120	35,354
Spain	--	--	--	93	1,943	1,976
Total[3]	349	17,755	18,393	1,031	35,063	37,331
Duluth:						
Canada	208	6,526	8,293	77	2,294	2,849
Germany, Federal Republic of	(2)	5	5	--	--	--
Greece	--	--	--	36	887	1,432
Total[3]	208	6,531	8,298	113	3,181	4,282

See footnotes at end of table.

Table 21.—U.S. imports for consumption of hydraulic cement and clinker, by customs district and country —Continued

(Thousand short tons and thousand dollars)

Customs district and country	1986			1987		
	Quantity	Value		Quantity	Value	
		Customs	C.i.f.[1]		Customs	C.i.f.[1]
El Paso:						
Malaysia	(2)	3	5	--	--	--
Mexico	504	18,960	18,960	595	20,950	20,950
Total	504	18,963	18,965	595	20,950	20,950
Great Falls:						
Canada	(2)	65	65	(2)	13	13
Germany, Federal Republic of	(2)	21	23	--	--	--
Yugoslavia	--	--	--	(2)	10	10
Total	1	86	88	(2)	23	23
Honolulu:						
Australia	--	--	--	2	155	155
Japan	85	1,882	2,552	25	540	708
Korea, Republic of	10	368	495	21	1,063	1,138
Total	95	2,250	3,047	48	1,758	2,001
Houston:						
Colombia	152	3,345	3,822	33	789	891
Germany, Federal Republic of	(2)	207	256	(2)	54	64
Korea, Republic of	(2)	50	50	--	--	--
Mexico	105	1,898	2,683	74	1,453	2,182
Spain	577	15,586	17,896	642	12,644	17,502
Venezuela	(2)	7	12	--	--	--
Total[3]	835	21,083	24,719	749	14,940	20,639
Laredo:						
Mexico	182	5,804	5,804	301	8,978	8,978
Los Angeles:						
Bahamas	--	--	--	91	3,006	3,497
Canada	20	347	464	--	--	--
Denmark	11	764	1,130	13	451	1,115
France	(2)	59	66	202	4,569	6,107
Germany, Federal Republic of	(2)	93	109	(2)	40	48
Japan	375	10,622	12,619	435	10,347	15,503
Korea, Republic of	343	8,700	11,069	454	10,283	13,138
Spain	182	4,980	6,598	(2)	72	130
Taiwan	(2)	15	19	23	525	714
United Kingdom	(2)	1	1	--	--	--
Yugoslavia	(2)	235	424	(2)	47	88
Total[3]	933	25,816	32,499	1,218	29,340	40,340
Miami:						
Bahamas	58	1,652	1,880	50	1,434	1,618
Belgium-Luxembourg	3	179	332	2	128	242
Costa Rica	(2)	10	11	--	--	--
Denmark	--	--	--	4	349	400
France	--	--	--	10	320	407
Germany, Federal Republic of	--	--	--	2	6	8
Greece	--	--	--	53	1,161	1,677
Japan	(2)	39	51	--	--	--
Mexico	319	9,170	11,481	323	6,561	15,242
Spain	464	14,108	17,024	447	12,664	17,357
Venezuela	445	10,194	13,905	428	9,949	13,255
Total[3]	1,289	35,352	44,684	1,318	32,572	50,203
Milwaukee:						
Germany, Federal Republic of	--	--	--	(2)	14	16
Mobile:						
France	23	809	914	31	1,213	1,228
Greece	283	5,234	7,137	166	2,820	3,631
Mexico	245	3,881	4,695	339	5,001	6,835

See footnotes at end of table.

Table 21.—U.S. imports for consumption of hydraulic cement and clinker, by customs district and country —Continued

(Thousand short tons and thousand dollars)

Customs district and country	1986			1987		
	Quantity	Value		Quantity	Value	
		Customs	C.i.f.[1]		Customs	C.i.f.[1]
Mobile —Continued						
Spain	232	4,127	5,414	40	682	915
United Kingdom	--	--	--	29	496	659
Total	783	14,051	18,160	665	10,212	13,268
New Orleans:						
Belgium-Luxembourg	--	--	--	31	650	905
Canada	101	6,553	8,068	61	3,860	4,665
Colombia	46	900	1,134	--	--	--
France	434	12,834	15,709	179	1,217	6,719
Greece	58	1,460	1,498	222	5,135	6,528
Mexico	444	9,529	13,559	657	15,176	20,723
Netherlands	(2)	181	197	--	--	--
Spain	382	11,497	12,940	463	12,385	15,806
Venezuela	7	146	212	--	--	--
Total	1,472	43,091	53,337	1,613	38,423	55,346
New York City:						
Bahamas	7	222	294	--	--	--
Belgium	(2)	4	5	--	--	--
Canada	65	1,311	1,965	32	716	868
Colombia	29	833	1,118	2	49	77
France	--	--	--	58	1,590	1,594
Germany, Federal Republic of	(2)	10	13	(2)	43	45
Greece	648	13,562	17,485	638	15,432	21,969
Japan	1	779	784	--	--	--
Mexico	26	425	588	162	3,645	5,464
Spain	405	13,809	17,385	434	15,382	22,273
Venezuela	72	1,683	2,061	22	503	613
Total[3]	1,253	32,638	41,698	1,346	37,360	52,902
Nogales: Mexico	404	14,518	14,520	381	13,039	13,039
Norfolk:						
Bahamas	25	650	1,019	10	248	385
Canada	(2)	7	7	--	--	--
Colombia	17	474	582	--	--	--
France	25	2,367	2,591	70	2,468	3,118
Germany, Federal Republic of	(2)	3	3	(2)	11	13
Greece	--	--	--	16	386	621
Spain	211	2,558	5,379	323	8,560	11,812
United Kingdom	(2)	2	3	--	--	--
Venezuela	90	2,251	3,099	31	820	1,276
Total[3]	368	8,302	12,683	451	12,493	17,225
Ogdensburg:						
Canada	405	13,839	13,839	514	15,801	15,817
Netherlands	--	--	--	(2)	244	294
Total	405	13,839	13,839	514	16,045	16,111
Pembina: Canada	48	2,025	2,025	103	4,645	4,645
Philadelphia:						
Germany, Federal Republic of	(2)	5	6	(2)	187	204
Greece	23	503	568	62	1,209	1,424
Mexico	1	25	25	--	--	--
Netherlands	(2)	182	221	(2)	82	104
Spain	94	5,839	8,039	135	4,545	4,890
Turkey	(2)	2	5	--	--	--
Venezuela	--	--	--	17	404	629
Total[3]	119	6,053	8,864	214	6,427	7,251
Port Arthur:						
Mexico	26	662	782	--	--	--
Venezuela	159	2,911	3,636	--	--	--
Total[3]	185	3,573	4,418	--	--	--

See footnotes at end of table.

Table 21.—U.S. imports for consumption of hydraulic cement and clinker, by customs district and country—Continued

(Thousand short tons and thousand dollars)

Customs district and country	1986			1987		
	Quantity	Value		Quantity	Value	
		Customs	C.i.f.[1]		Customs	C.i.f.[1]
Portland, ME:						
Canada	11	599	599	12	584	584
Spain	13	269	303	--	17	20
Total[3]	24	868	902	12	601	604
Portland, OR:						
Japan	47	1,095	1,618	104	1,029	1,192
Korea, Republic of	37	1,382	1,749	31	1,939	2,470
Total[3]	84	2,477	3,367	135	2,968	3,661
Providence:						
Canada	39	1,651	1,970	40	1,278	1,613
Colombia	74	2,191	3,028	105	2,585	5,128
Greece	5	135	203	--	--	--
Mexico	78	1,939	2,947	45	1,046	1,674
Spain	67	2,364	2,971	--	--	--
Venezuela	13	370	552	6	162	258
Total[3]	276	8,550	11,671	196	5,071	8,673
St. Albans: Canada	399	13,018	13,018	406	12,650	12,650
San Diego:						
Canada	8	256	304	--	--	--
Japan	--	--	--	52	1,533	1,870
Mexico	694	22,373	25,015	631	21,507	22,347
Mozambique	--	--	--	10	259	273
Total[3]	702	22,631	25,319	693	23,299	24,489
San Francisco:						
Canada	139	4,556	6,188	121	3,196	6,485
China	(2)	6	12	--	--	--
Japan	37	1,022	1,283	--	--	--
Korea, Republic of	65	935	1,930	25	694	835
Mexico	108	3,086	3,480	233	6,027	6,371
Total[3]	368	9,605	12,795	380	9,857	13,691
San Juan, PR:						
Barbados	42	1,472	2,015	--	--	--
Belgium-Luxembourg	8	585	1,009	7	495	862
Brazil	1	92	138	1	51	70
Colombia	66	1,220	1,618	25	528	694
Denmark	4	336	542	9	786	1,004
Dominican Republic	1	16	21	--	--	--
Germany, Federal Republic of	1	56	63	--	--	--
Honduras	24	717	1,053	56	1,577	2,312
Japan	--	--	--	(2)	13	14
Mexico	5	134	241	24	773	919
Netherlands	1	49	71	--	--	--
Spain	3	238	598	16	711	746
Venezuela	34	1,329	1,847	--	--	--
Total[3]	191	6,233	9,216	149	4,934	6,621
Savannah:						
Germany, Federal Republic of	(2)	15	19	(2)	19	23
Japan	(2)	2	2	--	--	--
Spain	111	2,608	2,802	72	2,181	2,294
Venezuela	11	250	276	10	239	329
Total[3]	123	2,875	3,099	82	2,439	2,636
Seattle:						
Canada	335	12,392	13,423	556	20,592	21,641
Japan	156	3,757	4,679	151	3,619	4,285
Yugoslavia	(2)	10	43	--	--	--
Total[3]	491	16,159	18,145	707	24,211	25,926

See footnotes at end of table.

Table 21.—U.S. imports for consumption of hydraulic cement and clinker, by customs district and country —Continued

(Thousand short tons and thousand dollars)

Customs district and country	1986			1987		
	Quantity	Value		Quantity	Value	
		Customs	C.i.f.[1]		Customs	C.i.f.[1]
Tampa:						
Bahamas	4	102	117			
Colombia	383	8,277	10,505	286	6,819	9,329
Denmark	41	W	W	51	W	W
France	187	W	W	220	W	W
Greece	42	932	1,169	137	3,100	3,960
Mexico	1,066	18,979	27,083	1,167	29,979	31,637
Panama	15	344	345			
Spain	269	8,207	10,858	321	6,346	8,441
Venezuela	366	10,025	12,982	136	3,313	4,714
Total[3]	2,457	58,151	72,262	2,318	48,671	68,494
Virgin Islands of the United States:						
Colombia	25	1,272	1,345	7	225	238
Dominican Republic	1	21	23	[2]	14	15
Leeward and Windward Islands	4	109	173	1	15	29
Venezuela	7	325	364	33	794	838
Total[3]	37	1,727	1,905	41	1,048	1,119
Wilmington, NC:						
Colombia	127	3,687	4,468	139	3,414	3,041
Mexico	10	250	389			
Spain	6	186	226			
Total	143	4,123	5,083	139	3,414	3,041
Grand total[3]	16,319	468,993	562,427	17,726	488,532	606,588

W Withheld to avoid disclosing company proprietary data; included in "Total."
[1]Cost, insurance, and freight.
[2]Less than 1/2 unit.
[3]Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census, U.S. Department of Commerce.

Table 22.—U.S. imports for consumption of cement and clinker

(Thousand short tons and thousand dollars)

Year	Roman, portland, other hydraulic cement		Hydraulic cement clinker		White nonstaining portland cement		Total[1]	
	Quantity	Value (customs)	Quantity	Value (customs)	Quantity	Value (customs)	Quantity	Value (customs)
1983	3,104	109,791	1,005	33,633	160	18,014	4,268	161,439
1984	6,379	204,899	2,215	59,801	252	29,507	8,846	294,207
1985	9,581	306,472	4,633	103,067	274	27,890	14,487	437,429
1986	12,086	361,149	3,972	79,699	261	28,145	16,319	468,993
1987	13,782	384,989	3,668	79,373	276	24,170	17,726	488,532

[1]Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census, U.S. Department of Commerce.

WORLD REVIEW

World cement production increased only slightly. China continued to lead all nations in cement production, followed by the U.S.S.R., the United States, and Japan. Worldwide, the industry operated at an estimated 80% of capacity. Countries with excess capacity continued to seek new markets for their product. Although the United States continued to be a principal recipient of imports, the number of countries that exported cement to the United States continued to decline. Twenty-four countries exported cement to the United States in 1987, six fewer than in 1986; however, the volume of cement imported in 1987 was 1 million tons more than in 1986.

Foreign buyers continued to show interest in the U.S. cement industry. By yearend,

approximately 55% of U.S. cement production capacity had been acquired by foreign firms from eight countries. Seven of the top ten producing companies in the United States were owned by Western European parent companies, and several Japanese firms were negotiating the purchase of U.S. capacity.

The international issue of Rock Products magazine described individual plant construction, modernization, or expansion activities of the cement-producing nations.[4] Although there were no major additions to capacity reported, there continued to be considerable activity aimed at expanding existing capacity either through new construction or by upgrading existing facilities. The industry reported the introduction of new technology, primarily the installation of high-pressure grinding rollers and high-efficiency separators.

Egypt.—Consumer demand for cement continued to grow. Egyptian cement producers had several construction and modernization projects planned or in various stages of development. The addition of new capacity was aimed at reducing the country's dependence on imports. Alexandria Portland Cement Co. completed work on the No. 1 kiln at its Ameriyah plant. The No. 2 kiln was expected to go on line in early 1988. Both kilns have a capacity of 3,600 tons per day. Hewland Portland Cement Co. put its 220,000-ton-per-year, white cement plant on line at El-Minya.

Germany, Federal Republic of.—Demand for cement continued to decline and the industry continued to adjust capacity to meet long-term needs by closing older plants and outfitting others with state-of-the-art, high-efficiency separators.

Italy.—Italcementi-Fabriche Riunite Cemento S.p.A. installed a new 2,200-ton-per-day preheater kiln at its Sicily plant. Colacem S.p.A. installed a 2,000-ton-per-day preheater kiln at its Gubbio plant. Presa S.p.A.-Cementeriadi outfitted its 4,400-ton-per-day Robilante plant No. 3 kiln with a precalciner system.

Norway.—Norcem Cement A/S, Norway's only cement producer, was modernizing one of the two lines at its Dalen plant to increase the capacity to 3,600 tons per day. Norcem was also in the process of installing a high-pressure grinding mill at its Brevik plant.

Saudi Arabia.—Qassim Cement Co. commissioned the 2,400-ton-per-day-capacity addition to its Buraydah plant, and Yamama Saudi Cement Co. Ltd. completed a 3,300-ton-per-day production line at its Riyadh plant.

Spain.—Cementos Portland Morata De Jalon SA put its new 130-ton-per-hour mill on-line. Other producers sought to reduce operating costs and improve operating efficiency through application of automated centralized control systems and installation of grinding rollers and high-efficiency separators.

Turkey.—The Turkish cement industry continued its fourth consecutive year of production increases. To keep pace with rising demand, several new plants and modernization projects occurred during the year: Citosan (General Directorate) put its 660,000-ton-per-year plant on line; Bati Anadolu Cimento Sanayii AS was upgrading its No. 2 line at its Izmir plant from 1,400 to 1,900 tons per day; and Eskisehilr Cemento Fabrikasi TAS was converting its kiln to a preheater system to increase production from 770 tons per day to 1,500 tons per day. Other plants were in various stages of modernization including the installation of high-efficiency separators and raw material conveyance, grinding, and storage systems.

Table 23.—Hydraulic cement: World production, by country[1]

(Thousand short tons)

Country	1983	1984	1985	1986[p]	1987[e]
Afghanistan[2]	14	123	85	r e95	110
Albania[e]	925	[3]948	940	940	945
Algeria[e]	5,300	6,100	6,720	r7,120	7,170
Angola[e]	240	390	390	390	390
Argentina	6,198	r5,644	5,121	r e6,100	7,000
Australia	5,331	6,022	6,489	6,471	6,600
Austria	5,409	5,400	5,027	5,036	5,000
Bahamas	r26	--	--	(e)	--
Bangladesh[5]	338	301	265	322	[3]342
Barbados	--	e165	e240	219	220
Belgium	6,304	6,300	6,103	5,928	6,400
Benin[e]	331	331	331	331	331
Bolivia	361	315	418	328	330
Brazil	23,005	21,761	22,721	27,885	[3]28,076

See footnotes at end of table.

Table 23.—Hydraulic cement: World production, by country[1] —Continued

(Thousand short tons)

Country	1983	1984	1985	1986[p]	1987[e]
Bulgaria	6,221	6,302	5,838	6,285	6,280
Burma	369	343	526	478	[3]429
Cameroon	672	NA	NA	NA	NA
Canada	8,676	9,489	11,235	11,687	13,900
Chile	1,383	1,532	1,571	1,583	1,650
China	119,325	133,468	[e]157,100	[e]178,000	198,000
Colombia	5,264	5,816	6,294	7,121	[3]6,575
Congo	17	NA	64	[e]64	64
Costa Rica	425	[r]517	524	573	573
Cuba	3,562	3,689	3,508	[r e]3,640	3,900
Cyprus	1,039	940	727	952	955
Czechoslovakia	11,372	11,607	[e]11,300	[e]11,200	11,200
Denmark	1,827	1,839	1,917	2,237	2,200
Dominican Republic	1,217	1,260	1,110	1,175	1,200
Ecuador	[r]1,565	[r]1,910	2,167	[r e]2,300	2,200
Egypt	6,063	7,165	6,337	8,391	11,600
El Salvador	[r]479	[r]440	496	488	[3]669
Ethiopia[e]	190	265	275	275	275
Fiji	121	108	103	102	105
Finland	2,102	1,814	[e]1,760	[e]1,760	1,760
France	27,011	25,049	25,955	[e]25,900	[3]25,970
Gabon	132	229	270	232	[3]151
German Democratic Republic	12,987	12,737	12,795	13,126	12,700
Germany, Federal Republic of	33,583	31,867	28,393	29,299	27,900
Ghana	[e]320	252	400	241	[3]302
Greece	15,648	14,904	15,067	14,706	14,800
Guadeloupe	[e]176	188	190	199	210
Guatemala	498	[r]462	580	710	[3]1,459
Haiti[e]	[3]238	240	240	200	220
Honduras	535	589	383	386	440
Hong Kong	1,892	2,037	2,023	2,465	2,400
Hungary	4,677	4,569	4,054	4,239	[3]4,578
Iceland	127	130	126	122	120
India	27,350	32,000	36,409	40,124	[3]40,763
Indonesia	9,025	9,765	11,112	12,060	13,000
Iran[e]	11,000	[r]13,000	[r]13,760	[r]13,530	13,600
Iraq[e]	6,170	8,800	8,800	8,800	11,000
Ireland	1,638	1,518	1,606	1,541	1,545
Israel	2,269	2,271	2,227	2,270	2,270
Italy	43,229	41,643	40,429	38,956	39,900
Ivory Coast	702	591	748	855	[3]719
Jamaica	305	288	264	266	275
Japan	89,167	86,928	80,311	78,535	77,000
Jordan	1,401	2,192	2,230	1,978	2,500
Kenya	1,411	1,283	934	1,446	[3]1,456
Korea, North[e]	8,800	8,800	8,800	8,800	8,800
Korea, Republic of	23,459	22,501	22,514	25,797	[3]28,287
Kuwait	1,239	1,305	1,315	1,118	1,120
Lebanon	1,653	1,378	[e]1,100	[e]1,000	1,000
Liberia	94	93	105	107	100
Libya[e]	5,500	6,600	7,260	[3]2,289	[3]2,976
Luxembourg	389	375	325	[e]330	340
Madagascar	39	39	39	39	39
Malawi	78	77	[e]70	76	77
Malaysia	3,562	3,824	3,448	3,501	3,130
Mali	[e]22	28	21	[e]22	28
Martinique[e]	[r]228	[r]210	220	220	220
Mexico	18,814	[r]20,322	22,796	21,772	22,000
Mongolia	[r]182	[r]155	166	[r e]220	220
Morocco	4,242	3,865	4,072	4,125	4,200
Mozambique[e]	[3]463	496	496	496	496
Nepal	50	43	35	102	110
Netherlands	3,425	3,501	3,209	3,417	3,440
New Caledonia[e]	66	66	66	66	55
New Zealand	878	907	951	[e]960	[3]994
Nicaragua[e]	110	110	110	110	110
Niger[e]	42	42	42	42	44
Nigeria[e]	3,970	3,300	3,680	3,860	3,860
Norway	1,837	1,705	1,764	1,929	1,870
Pakistan	5,443	5,178	[e]5,765	[e]5,760	7,530
Panama	360	335	336	370	385
Paraguay	169	120	51	197	165
Peru	[r]2,166	2,066	1,937	2,346	2,200
Philippines[e]	4,831	4,025	3,395	3,811	3,860
Poland	17,857	18,409	16,535	17,416	[3]17,747
Portugal	6,683	6,106	6,913	6,901	6,400
Qatar	413	527	350	340	330
Romania	15,397	15,450	13,490	15,670	15,760
Saudi Arabia	8,957	7,882	9,149	10,130	10,140

See footnotes at end of table.

Table 23.—Hydraulic cement: World production, by country[1] —Continued

(Thousand short tons)

Country	1983	1984	1985	1986[p]	1987[e]
Senegal	435	424	419	397	[3]410
Singapore	3,476	3,110	2,195	1,989	[3]1,684
South Africa, Republic of	8,705	9,025	7,754	6,885	6,830
Spain (including Canary Islands)[7]	33,771	28,038	26,673	[e]26,500	25,800
Sri Lanka[e]	[3]558	551	660	660	660
Sudan	[e]220	194	213	[e]220	220
Suriname[e]	[3]82	55	55	55	55
Sweden	2,469	2,638	2,425	2,336	2,425
Switzerland	4,516	4,609	4,689	4,842	4,400
Syria	3,996	4,720	4,736	4,630	4,630
Taiwan	16,325	15,690	15,893	16,321	[3]17,266
Tanzania[e]	460	[3]408	330	330	330
Thailand	8,006	9,093	8,726	8,723	9,400
Togo	256	268	313	384	[3]407
Trinidad and Tobago	[r]433	447	362	372	350
Tunisia	3,142	3,061	3,372	3,289	3,750
Turkey	14,986	17,348	19,380	22,050	[3]24,228
Uganda[e]	22	22	22	22	22
U.S.S.R.	141,268	143,453	144,096	148,943	150,000
United Arab Emirates	2,280	4,415	[e]4,400	2,745	2,745
United Kingdom	14,767	14,860	14,704	[e]14,770	14,770
United States (including Puerto Rico)	71,347	78,699	78,859	79,916	[3]79,501
Uruguay	442	368	346	375	[3]442
Venezuela	4,899	5,272	5,836	6,113	5,950
Vietnam[e]	[3]1,023	1,210	1,430	1,700	[3]1,667
Yemen (Sanaa)	[r]937	[r]1,532	1,543	1,279	[3]838
Yugoslavia	10,573	10,268	9,952	10,061	[3]9,880
Zaire	565	[r]589	485	[r e]440	440
Zambia	171	266	349	368	[3]413
Zimbabwe	639	NA	NA	NA	NA
Total	[r]1,010,051	[r]1,036,392	1,056,660	1,100,814	1,138,673

[e]Estimated [p]Preliminary [r]Revised NA Not available.
[1]Table includes data available through July 8, 1988.
[2]Data are for the year beginning Mar. 21 of that stated.
[3]Reported figure.
[4]Less than 1/2 unit.
[5]Data are for the year ending June 30 of that stated.
[6]Converted from officially reported data provided in terms of 94-pound cement bags.
[7]Excludes natural cement.

TECHNOLOGY

The industry continued to introduce and experiment with various types of technology aimed at conserving energy and improving plant operating efficiency. Among the more notable developments were industry efforts to expand the use of waste materials in cement kilns as an alternative to fuel oils, natural gas, and/or coal. In a paper presented at the 23d International Cement Seminar in December 1987, industry representatives described progress, challenges, and opportunities in using solvent-derived fuels (SDF) in cement kilns.[5] The paper concluded that while the use of SDF can lead to significant fuel cost savings, there are public acceptance, regulatory, and other institutional barriers that must be overcome.

Results of a 2-year operational test also showed that increases in both operating capacities and energy savings can be obtained using different grinding procedures. Heidelberger Zement AG tested new grinding procedures at its plant in Leimen, Federal Republic of Germany. The pilot test was designed to determine the energy savings and capacity increases of a ball mill when combined with a high-pressure grinding roller. Tests concluded that by combining the grinding roller with the ball mill, capacity increases of up to 40% and energy savings of 20% were achieved. In the case of finish grinding, energy savings of up to 40% were achieved.[6]

The Bureau of Mines published the results of a 1-year study to test and evaluate the resistance of sulfur concrete to corrosion and to examine its permeation characteristics and performance in various industrial environments. The study is part of a Bureau program to find new uses for the Nation's plentiful supply of sulfur in construction materials. Results indicate that sulfur concrete is a corrosion-resistant material that demonstrates superior performance in environments where conventional materials fail. It has improved resistance to chloride and sulfate permeability when compared with portland cement concrete.[7]

[1]Mineral industry specialist, Branch of Industrial Minerals.

[2]U.S. Department of Commerce, International Trade Administration. Construction Review. V. 33, No. 6, Nov.-Dec. 1987, pp. 2-24.

[3]Engineering News-Record. ENR Materials Prices. V. 220, No. 1, Jan. 1988, pp. 42-46.

[4]Rock Products. Cement International. V. 91, No. 4, Apr. 1988, pp. 63-88.

[5]Rock Products Magazine Proceedings, Rock Products 23d International Cement Seminar. 1987, pp. 45-77.

[6]Work cited in footnote 4.

[7]Wrzesinski, W. R., and W. C. McBee. Permeability and Corrosion Resistance of Reinforced Sulfur Concrete. BuMines RI 9157, 1988, pp. 1-13.

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